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12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)
Basic research has been conducted in the design and analysis of algorithms. Fundamental questions in computer software and systems research have been addressed, concentrating on two particularly promising areas:
  (1) practical approaches to problems for which only the existence of asymptotically fast algorithms is guaranteed and
  (2) efficient strategies for parallel computing in realistic, resource-bounded environments.
The former is motivated by dramatic recent results in discrete mathematics. The latter is driven by continuing advances in parallel computer architectures.

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Final Technical Report
ONR Contract Number N00014-88-K-0343
01 May 1988 – 30 April 1991

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Department of Computer Science
University of Tennessee

Key Results

We have designed constructivization strategies with which it is now possible in principle to write down asymptotically-fast decision and search algorithms for problems previously known only to possess such methods. Thus this development eliminates the nonconstructive nature·of tools previously required.

We have designed new parallel algorithms that simultaneously optimize both parallel time and parallel space. Thus our methods attain linear speedup and yet only require a constant amount of extra space per processor, even when the number of processors is bounded (as it of course is in practice).

Productivity Statistics

- Publications

    - Refereed papers published: 23

    - Refereed papers submitted but not yet published: 4

    - Unrefereed reports and articles: 6

- Technical reports: 18

- Book chapters: 4

- Grad students: 6

- Significant presentations: 8

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Representative Publications

- M. R. Fellows and M. A. Langston, "Nonconstructive Tools for Proving Polynomial-Time Decidability," *Journal of the ACM 35* (1988), 727–739. This publication developed powerful algorithmic tools, popularized their applicability, and helped open new research areas.

- B.-C. Huang and M. A. Langston, "Practical In-Place Merging," *Communications of the ACM 31* (1988), 348–352. This publication devised an elegant solution to a difficult problem, has been widely cited, and produced new methods now adopted in textbooks.

- M. R. Fellows and M. A. Langston, "On Search, Decision and the Efficiency of Polynomial-Time Algorithms," *Proceedings, 21st ACM Symposium on Theory of Computing* (1989), 501–512. This publication contains ground-breaking techniques for eliminating the nonconstructivity inherent in many well-quasi-order tools.

- X. Guan and M. A. Langston, "Time-Space Optimal Parallel Merging and Sorting," *IEEE Transactions on Computers 40 (1991)*, 596–602. This publication described new PRAM-style algorithms for real parallel machines, provided a foundation for many subsequent results, and has helped bridge the gap between theory and practice.

Software Produced

- Programs for obstruction set isolation and verification. This package automates exhaustive case-checking, greatly expands the horizon of feasible computation, and serves as a testbed for self-reduction methods.

- Time-space optimal parallel merging routines. This package has been implemented on both shared-memory and distributed-memory machines, scales with problem size, and highlights synchronization bottlenecks.